Aquarius MWR
Part 1: Geolocation

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CONAE Geolocations

Brightness Temperature
Channel: 23H, all horns
All Ascending passes
2011, 276-365
CONAE EIA >65 OR <45

2011, 331
All channels, all horns
Ideal: 52 & 58 degrees
RSS Geolocation

• Algorithm input
  – Spacecraft position/velocity/orientation data
    • From Aquarius L1A
    • Interpolated to MWR observation times
  – Pointing angles (alpha, beta) of each horn and channel

• Run geolocation algorithm
  – Output: latitude, longitude, EIA, azimuth

• Comparing CONAE and RSS geolocations
  – There are issues with CONAE geolocations at high latitudes
  – Present in nearly every orbit
Geolocation Differences

- Geolocation differences near the equator (+/-5 degrees)
  - Goal: within 0.005 degrees (~0.55 km)
  - Reality:
    - ~1.3 km for 37 GHz
    - ~0.5 km for 23 GHz
- Adjust pointing angles
  - Find the combination of alpha/beta that minimized the RMS of great circle distance
  - Varied each pointing angles by +/- 0.1 degrees
    by 0.01 degrees
Geolocation Differences

Nominal Alpha/Beta Values

Adjusted Alpha/Beta Values

RMS Great Circle Distance (km)

All horns, all channels less than 0.2 km

Near the equator
Geolocation Differences

Lat/Lon at 40 N
- Nominal Alpha/Beta Values
- Adjusted Alpha/Beta Values

Lat/Lon at 40 S
- Nominal Alpha/Beta Values
- Adjusted Alpha/Beta Values

RMS Great Circle Distance (km)
Geolocation Summary

• The adjusted pointing angles do NOT improve the RMSD away from the equator
  – Points to an issue with CONAE’s geolocations

• Moving forward:
  – Use the nominal pointing angles in our geolocation algorithm
  – Geolocation merits
    • Verified geolocation algorithm, using spacecraft data
    • Removes the odd values at high latitudes and scattered outliers
    • Otherwise, fairly good agreement between geolocations
Geolocation Difference Difference Histogram

2011, 276-365

90% of within 2 km

Great Circle Difference (km)
Aquarius MWR
Part 2: Geophysical Retrievals
Geophysical Retrievals

- RSS retrievals
  - Algorithm initialized
    - RSS geolocations
    - Reynolds SST
    - NCEP winds
    - Linwood’s MWR brightness temperatures (23H, 37H, 37V)
  - Output retrievals
    - SST, wind, water vapor, cloud liquid water, rain rate
- Collocate to F17/WindSat retrievals
RSS Geophysical Retrievals
Averaging period: 2011, 276-365

Water Vapor (mm), ASC/PM

Water Vapor (mm), DSC/AM
RSS Geophysical Retrievals

Averaging period: 2011, 276-365

Cloud Liquid Water (mm), ASC/PM

Rain Rate (mm/hr), ASC/PM

Cloud Liquid Water (mm), DSC/AM

Rain Rate (mm/hr), DSC/AM
Collocated F17/WindSat Vs. MWR Atmospheric Water Vapor

Bias: 4.2 mm
STD of difference: 3.4 mm
MWR Retrievals

• Rain affects salinity retrieval accuracy
  – Two fold
    • Rain contamination
    • Fresh water input
  – Rain may cause errors greater than 0.1 psu
    Can be higher for intense, fast-moving storms

• Correction via satellite rain
  – MWR
  – Collocated F17/WindSat data
Rain contamination:
Rain $\rightarrow$ higher $T_B$
Higher $T_B \rightarrow$ lower SSS

Rain-induced SSS change:
Rain $\rightarrow$ fresh water input
Fresh water $\rightarrow$ lower SSS
Aquarius : F17/WindSat
Collocation Time Difference

• 92% of AQ collocations with F17/WindSat are within 90 minutes

• Aquarius SSS collocates with MWR within 3 minutes

• MWR has better collocations in time with salinity retrievals
Rain Correction

• Collocated F17 and WindSat data
  – Up to 90+ minutes separation in time
  – Intense rain events and fast-moving storms

• MWR’s advantages
  – MWR retrievals within 3 minutes of salinity retrievals
  – Continued satellite inter-calibration to tune our geophysical retrieval algorithms